Quarterly Progress Report

Grant #7310006

Arctic Thermal Shutters and Doors

Arctic Sun, LLC

October 12, 2013 through December 31, 2013

Deliverables Submitted: No deliverables were submitted during this quarter.

Budget: No invoices were submitted for reimbursement since the last quarterly report. Attached is a reimbursement form with back-up for all of the expenditures from October 12, 2013 through December 31, 2013 totaling $21,726.13. The majority of the expenses were for locating and procuring the materials, and then building the shutters and doors for the field tests. We also completed constructing the test box and installed the data collection equipment. All of these expenses are summarized on the attached Excel spreadsheet titled "4th Qtr Grant report 2013." Since inception, $45,000 has been advanced and $72,875.44 has been expended. The overall project remains on budget.

Schedule Status: During this quarter, Arctic Sun constructed the testing box and began running baseline data collection as per the plan. Staff also spent significant time fine-tuning the blown-in shutter design, which required rebuilding the prototype mock-up twice. The design is now complete and is attached to this report. This will put us back on schedule with the blown-in portion of the project. All other aspects of the project are progressing fine, but are toward the tail end of the schedule because of the late start for the grant. Staff completed the field test site proposal, which is also attached.

Percent Complete:

Task	Start Date	End Date	Deliverables	Percent Complete
Complete ridged shutter and door design	Jan 2013	April 2013	Design Plans	100%
Complete Blown-in shutter design	Jan 2013	May 2013	Design Plans	100%
Develop plans for testing box and project instrumentation	Jan 2013	May 2013	Testing box design and performance monitoring plans	100%
Construct testing box	March 2013	May 2013		100%
Purchase and delivery of materials for test shutters and doors	March 2013	July 2013		30%
Construct shutters and doors; identify field test site locations	March 2013	Aug 2013	Field test site proposal	30%

Work Progress:

Task 1. Ridged shutter and door design; The final designs were approved.

Task 2. Blown-in shutter design; The UV stability test on the EPS beads was completed. The test window-box that was placed outside June 28th was opened after 150 days of full exposure to the Fairbanks sun. The beads were closely examined for any signs of deterioration resulting from this solar exposure and/or the dramatic swings in temperature within the test container. The beads showed no detectable signs of any degradation. The test beads were compared

directly with a control group of beads, and were impossible to distinguish. The color was identical, and the test beads maintained the same resiliency, texture, roughness, consistency and firmness. There was no flaking or scaling of any of the beads. The conclusion was the beads should serve the purpose well for many years.

We tested the timed relays for their applicability in shutting the blower off, and were very pleased with the results. This should be an effective way to control the unit. During final testing of the prototype, we adjusted the ducting to be able to maintain a reliable, complete fill of the cavity. The final blown-in shutter design is attached for approval.

The photo below demonstrates the beads being blown into the cavity.

The photo below shows the drop-gate open and the beads falling into the storage area.

Task 3. Develop plans for testing box and project instrumentation; Arctic Sun's plans for the testing box were approved.

Task 4. Construct testing box; The finishing touches were complete on the testing box, and the monitors are now recording the baseline data. We will run the box in baseline mode for a month to assure we have ample data to quantify its base performance at various temperatures.

Task 5. Purchase and delivery of materials; Staff spent time researching the best suppliers for various parts, and started to procure the materials to construct the field test rigid shutters and doors. We now have enough supplies to have staff begin construction of some of the units.

Task 6. Construct shutters and doors; identify field test locations; Staff began assembling the rigid shutters and doors for the field tests and several units are currently in various stages of completion. The field test location proposal was put together and is attached for approval. It was decided to include just one location for an initial blown-in shutter test. We are curious to see exactly how several of the components in the unit perform in extreme cold before we test additional units. Some components, like the drive motor, have not been tested or rated below the industry standard of 20 below zero. The manufacturer is confident they will function fine, but we do not have a guarantee. Our preference is to field test the first unit to check its performance before installing several more. This will provide us the opportunity to test different replacement parts should the initial ones prove inadequate.

Future Work: Shortly after this reporting period, staff installed the first rigid shutter on the test box and started collecting data on its performance. After we are satisfied we have adequate data in different temperature ranges, we will switch and test other units. One additional test we will perform is with a similar rigid shutter with a core of expanded polystyrene foam instead of the vacuum panel core. We are curious to see if the extra expense for the vacuum panel is justified by a corresponding increase in performance.

Staff will continue to assemble shutters and doors and install them in the field test locations as soon as our blown-in shutter design and the proposed installation locations are approved.

We do not foresee any significant problems with the next phases of the project.